FX-Net

An Expandable Air Quality Workstation

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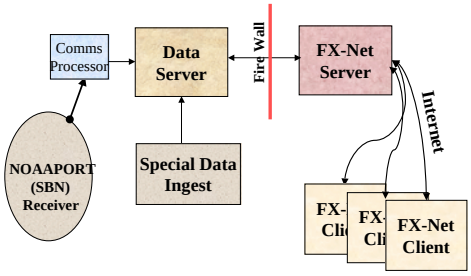
INTRODUCTION

The flexibility of the FX-Net ingest architecture allows for the addition of real-time operational and experimental data sets. Utilizing the AWIPS display server software, newly ingested data are rendered as standard products, allowing the user to manipulate them with all available FX-Net display tools. Capitalizing on this capability, the latest release of FX-Net is the first fully integrated Air Quality version if this Internet-based meteorological workstation. Significant additions to the real-time data set include recently developed, experimental, air chemistry model output and air quality observations. As in previous versions, the real-time data sets also include satellite imagery, weather forecast models and observations (Wang and Madine, 1998).

SYSTEM OVERVIEW

FX-Net is an expandable weather forecasting workstation that provides access to NWS observational and atmospheric forecast model data via the Internet. Data are visualized through an AWIPS-like interface on a Windows PC. Bandwidth limitations are addressed by using new data compression techniques along with multithreaded client-side processing and communication. The user interface is a Java client that is easily installed on a desktop or laptop PC creating a portable, full-function forecasting workstation that may be ported to any location. For optimal performance the PC should be running WINDOWS 2000 or XP, have a 500 MHz Processor, 512 Mbytes of memory, and be connected to a 56 kbps or faster network.

FX-Net System Description



WAVELET DATA COMPRESSION

Wavelet transform-based data compression is one of the most effective data compression techniques that emerged and evolved in 1990s. This technique takes advantage of the wavelet basis functions that are localized in both time and frequency, and combines that with a well designed quantization scheme to achieve superior data compression.

As the volume of meteorological data sets grows rapidly, It becomes essential to compress this volume so that the data sets can be transmitted and stored promptly and efficiently. We applied the wavelet data compression technique to the typical meteorological imagery and grid data and achieved very promising results. With a small and acceptable amount of loss, 95% - 98% volume reduction for the test data sets was achieved.

The compression has also been applied to the output grid of high resolution mesoscale models. Figs. 1 and 2 are the original and 50:1 compressed Eta temperature field that are displayed as pseudo-color images.

The wavelet compression package has been used in the FX-Net system since 1998.

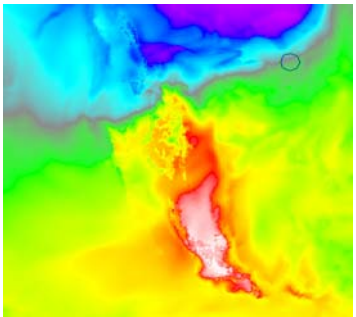


Figure 1. Eta12 temperature field at 850 mb, original

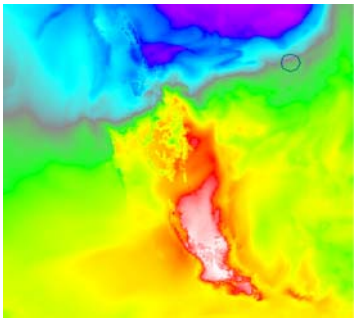
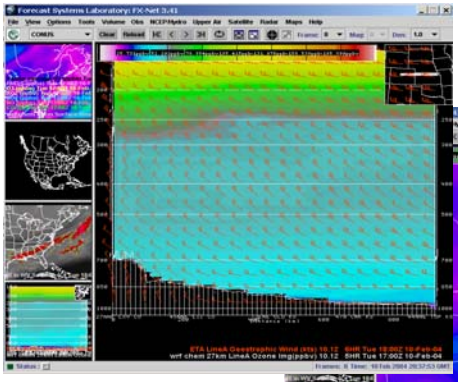


Figure 2.. Same temperature field with 50:1 compression

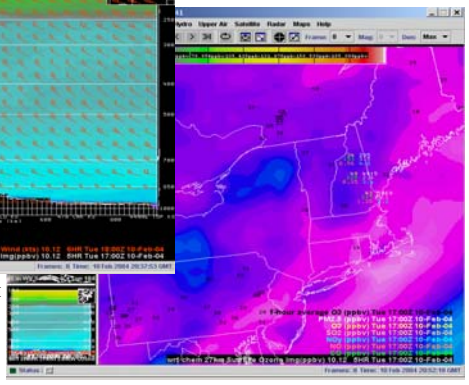
FX-NET AND THE AIRMAP PROGRAM

The FX-Net system has been a part of New England Climate and Air Quality programs since 1999. In 1999, as a part of the New England Climate Initiative, FX-Net was used in the Plymouth State College classroom as a tool for visualizing meteorological models and observational data.

Via the AIRMAP program, headed at the University of New Hampshire, NOAA conducts collaborative air quality regional modeling, analysis and prediction studies. As a result of this collaboration FSL has integrated experimental models, AIRNOW data, and AIRMAP observations into the FX-Net workstation. FSL has continued to support and upgrade the initial FX-Net system installations at Plymouth State University and at the University of New Hampshire. FSL has participated in several field studies, including the 2002 TAQ field study.



Cross Section Display of the WRF/CHEM Ozone Forecast with Geostrophic Winds



WRF/CHEM Ozone Forecast and AIRMAP Surface Observations

FUTURE SUPPORT OF AIRMAP GOALS AND A.Q. FORECASTING

The FX-Net group plans to aid the AIRMAP scientists by ingesting experimental models and air quality observations in support of their research goals. Among these goals are; studies to determine the influence of local emissions vs. pollutants transported from other regions, investigations of the relationship between weather and air quality, development of models to simulate atmospheric transport and air quality and producing air quality forecasts. Plans are also pending to utilize FX-Net during the summer 2004 New England Air Quality Study – Intercontinental Transport and Chemical Transformation (NEAQS-ITCT) field study. It is also hoped that state and local forecasters will have access to FX-Net to help fulfill their real-time air quality forecasting requirements. A real-time evaluation of the system during the ozone season is proposed.

OTHER FX-NET INSTALLTIONS AND USERS

FX-Net is an operationally proven system. Four National Weather Service Regional Headquarters offices have FX-Net systems installed for use by their Incident Meteorologists (IMETS). The system has been the backbone of their Fire Weather field operations. Both the IMETS and the fire weather forecasters at the National Interagency Fire weather Center (NIFC) have used FX-Net as their primary weather workstation for the 2002 and 2003 fire seasons.